For Sir Benj Brodie Bart
from the Author St Georges

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AN ESSAY

ON

THE ORIGIN AND NATURE

OF

TUBERCULOUS

AND

CANCEROUS DISEASES.

READ TO THE MEDICAL SECTION OF THE BRITISH ASSOCIATION,
ON THE 23RD OF AUGUST, 1836,

BY

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ADVERTISEMENT.

The following paper contains topics of sufficient importance to occupy volumes, and the Author might have thus extended it, had he made use of the various facts within his knowledge capable of illustrating one of the most important subjects which can engage the attention of medical men—namely, the true nature of tuberculous diseases. But it was necessary to compress the statement of the facts and views he had to adduce within the narrow compass of a communication fitted for the small space of time allowed for the reading of a paper to the Medical section of the British Association. It is his intention to follow up this interesting subject, by availing himself of every opportunity which offers of post mortem examinations in the extensive hospitals of the House of Industry of this city, which contain between two and three hundred patients; of examining animals which die of tuberculous diseases; and of extending his experiments upon living animals, in order to ascertain how far unhealthy regimen is capable of producing tubercles, and of learning if possible whether they are capable of absorption by a change to a healthy regimen, which engages the important question, whether or no tuberculous diseases admit of a cure; and he hopes that others, unbiassed by pre-conceived notions, will favour those views by pursuing the same interesting investigation. It will, of course, be necessary to recur to the use of the microscope, and to adopt the most minute injections.

This paper is given to the Public as it was read at the British Association, with a Postscript, however, containing such objections as were made at the time to the Author's views, and his replies to those objections.

Rutland-square, Dublin,
October 20, 1836.

AN ESSAY ON THE ORIGIN AND NATURE OF TUBERCULOUS AND CANCEROUS DISEASES.

When we consider the mortality that arises from tuberculous diseases, which, on a rough calculation, may be estimated, in these countries, where so many, from various causes, lead unnatural sedentary lives, at a fourth of the entire population, the vast importance of the subject ought surely to demand above all others the attention of the medical section of this Association.

I shall not make any farther preliminary observations, but rush at once *in medias res*, and endeavour to condense, as closely as I can, a subject upon which so much has been written, but which, in my mind, has failed to afford any satisfactory explanation of the true nature and origin of those bodies termed tubercles; for, without a true knowledge of both, we are not likely either to cure or prevent this, the greatest pest of mankind. Our present knowledge respecting tuberculous diseases is chiefly derived from the writings of Bayle, Laennec, Andral, Chomel, Louis, and Lombard amongst the French, and from Stark, Baron, Carswell, Todd, and Clarke amongst our own countrymen.

With respect to the appearance and structure of tubercle, I shall first give, as briefly as possible, Laennec's description, and afterwards that of Doctor Carswell. The celebrated Laennec observes, that the matter of tubercle may be developed in the lungs under two principal forms, that of insulated bodies and infiltration; and that whatever be the form under which the tuberculous matter is developed it presents at *first* the appearance of a grey *semi-transparent* substance, which gradually becomes yellow, opaque, and very dense, so much so, that Bayle regarded tubercles in that state as accidental cartilages. Afterwards the tubercular substance gradually acquires a fluidity nearly equal to that of pus; it being then expelled through the bronchi, cavities are left, vulgarly known under the name of *ulcers of the lungs* and vomicæ, but which Laennec designates *tuberculous excavations.*

He then proceeds to describe, with the accuracy of the most assiduous and patient observer of nature, the various forms of tubercle. Two of them present themselves under the form of *com-*

pact, rounded, insulated bodies ; two others he terms tuberculous infiltration, in which the tuberculous mass presents no regular form, and is of a consistence between jelly and cartilage.*

"Tuberculous matter," says Doctor Carswell, "is a pale yellow, or yellowish grey, opaque, *unorganized* substance, the form, consistence, and composition of which vary with the nature of the part in which it is formed, and the period at which it is examined."† It is to be found most frequently in the mucous system of the respiratory, digestive, biliary, urinary, and generative organs. It is also met with, though not so frequently, on the surfaces of serous membranes. But in fact there is no tissue or organ, not even bone, exempt from the formation of tubercle. The external configuration or form of tuberculous matter, according to the same author, is purely *accidental*, depending upon the form of the part, in which it is as it were moulded into the shape it assumes. As to its consistence and colour, he compares it to a mixture of soft cheese and water, but in another part states, "that tubercles often present the form of detached tubes or globular membranes, rolled up and mixed with tuberculous matter, like layers of boiled albumen or dead hydatids ;" a circumstance which, he adds, "has been taken advantage of to support the theory of the hydatic origin of tubercle." Doctor Clarke's description of tubercle is borrowed altogether from that of Doctor Carswell.

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* Forbes's Laennec, 254. † Encyc. of Medicine, iv. 253.

This last author, as well as Andral, differ from Laennec in the opinion that it is always at first deposited in the form of grey semi-transparent bodies which afterwards become yellow or opaque. They assert that it as often presents the latter appearance when first deposited. He also differs from Laennec in the statement that the softening process always commences in the centre of each tubercle. With respect to the locality of tuberculous bodies, the lungs, and particularly at their upper and back part, is their most favoured resort. This is so much the case that M. Louis lays it down as a rule that tubercles are always found in the lungs when they exist in any other organ of the body. Next to the lungs, tuberculous formations are found most commonly on the surface of the small intestines; then in succession, the liver, spleen, organs of reproduction, brain, and cerebellum may be esteemed most liable to them. It is rare, however, to find the tuberculous matter confined to one organ in the same individual; it is generally present in two or three organs, as the lungs, intestines, and bronchial or mesenteric glands.

Those who consider tubercle as organizable, have esteemed the process of softening as a consequence of the death of this substance; and Laennec states that it always commences at the centre, and proceeds towards the circumference. This is denied by Doctor Carswell. But in our researches to ascertain the true nature of tubercle, I do not consider it of much consequence whether the softening process begins in the centre or at the circumference. From my own observation, I should be inclined to consider it as, in general, commencing in the centre; for on examination of those who have died of tubercular phthisis, I have constantly found cysts of cartilaginous hardness containing the softened tuberculous matter. These cells often contain a "substance of a soft, chalky, or cretaceous character,"* and sometimes there remains only a nucleus of cretaceous or osseous matter, which states may be considered the last transmutation which the tubercle is capable of undergoing. As to their chemical composition, they consist of albumen, gelatin, fibrine, muriate of soda, phosphate of lime, and carbonate of lime. It is now universally acknowledged by practitioners, that although tubercles are the frequent cause of inflammation, yet this process has nothing to do with their formation.

Doctor Jenner and Doctor Baron threw considerable light upon their remote cause, for by feeding rabbits on unhealthy aliment, depriving them at the same time of exercise, and confining them in cold, dark, damp places, they induced the growth of tubercles, which, as Doctor Baron asserts, had at their first appearance the hydatid or vesicular character, but *that* in their transmutations they became solid tubercles.

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* Encyc. of Medicine, vol. iv. p. 266, and Pl. IV. Fig. 4 of Carswell's Delineations of Organic Diseases.

Last September I repeated the experiment by confining three rabbits in a small, damp place, and gave them no other food than common garden garbage; in about two months they died. On opening them no hydatids were found, but both liver and lungs were studded with diminutive white tubercles about the size of small shot, and which had an appearance of medullary matter or hardened curd. Doctor Collin Arrott of Philadelphia happened to call on me the 4th of last November, whilst examining one of these rabbits, and witnessed the appearances detailed. They exactly resembled those delineated by Carswell in the substance of the liver of a rabbit, in Plate II. Fig. 6 of his Illustrations of Tubercle.

This experiment, when coupled with those of Doctor Jenner and Baron, prove that diet of a quality unfitted for due nourishment, when conjoined with a damp, vitiated atmosphere, and privation of exercise, are capable of producing in an animal either hydatids or tubercles; and I should therefore infer from this circumstance, as well as from *post mortem* observations on human subjects, that the same causes are capable of producing *either the one or the other*, and that we are not called upon to conclude with Doctor Baron, for whose opinions, however, I feel the greatest deference, that tubercles are nothing more than hydatids that have undergone transmutation, or, in other words, that the first appearance of tubercle is always vesicular or hydatid.

The prevailing and most general doctrine respecting tubercles is that they are caused by that undefined, multiform, or Protean state of the constitution termed scrofulous, which I cannot but look upon as a most convenient term, calculated to cloak our ignorance whenever we meet with chronic sub-inflamed tumours or ulcers to which we cannot apply any more definite appellation. Thus, for instance, we apply indifferently the same name to the chronic enlargement of the cervical glands which occur in children born either of healthy or unhealthy parents, or who may themselves either evince every appearance of robust health, or that want of it which is indicated by a wan, bloated countenance, deranged digestion, and tumid abdomen. We call also those chronic enlargements of the same glands scrofulous, which arise immediately after the eruptions of measles, scarlatina, small-pox, or the papular eruption of venereal complaints; and we endeavour to satisfy ourselves that in such cases scrofula must have been lying latent in the constitution, and was only *then* brought into action by the debilitating effects of the exanthemata mentioned, although the subjects of this supposed scrofula might have previously enjoyed the most perfect state of health.

If a patient has a foul ulceration of the throat or of the nares, with or without exfoliation of the bones, and if we cannot, in consequence of the infancy of the patient or other objection, call it venereal, we instantly make use of this most convenient cognomen, always at hand for service, and without hesitation christen the disease scrofula.

It is chiefly owing to this indiscriminate classification of local complaints under one denomination, which bear some similarity to each other, but arise from most dissimilar causes or morbid states of the constitution, that has induced many to question the claim of the *ars medica* to the rank of a science. But it must be acknowledged, that the present generation have taken the right path to remove this stigma from medicine, by endeavouring to place its doctrines on the solid foundation of morbid anatomy, and a more accurate nomenclature.

These observations, which may be considered trite and unnecessary, I am forced to make when I find the acute and laborious industry of Doctor Carswell and others has only led them to the conclusion, that tubercles in the lungs and elsewhere are depositions of unhealthy, coagulable lymph incapable of becoming organized, and similar in every respect to that found in scrofulous enlargements of the cervical or mesenteric glands. Such, in a few words, as we shall see by and by, are, I believe, also the opinions of Doctors Clarke and Todd, and is the general doctrine of the day concerning tuberculous diseases.

As an illustration that such is the governing opinion, we find Doctor Carswell insisting upon the curability of tuberculous disease of the lungs, because we so frequently witness the disappearance of scrofulous swellings near the surface of the body. His words are, "when, therefore, enlarged glands in a scrofulous patient ultimately disappear, we almost with certainty conclude that we have witnessed the cure of a tuberculous disease. Tabes mesenterica, which consists in a similar diseased state of the mesenteric glands, has also been known to terminate favourably."*

This observation sufficiently proves, that in Doctor Carswell's mind scrofulous swellings of the glands and tubercles of the lungs are identically the same disease.

Doctor Clarke's entire work on scrofula and consumption is grounded on the supposition of this identity, for in a note at page 11 we find the following passage:—"The terms *scrofulous* and *strumous*, when strictly applied, have the same import as tuberculous," and are used in this sense throughout his work. And in another place he observes, "whatever may be the site, consistence, or form of tuberculous matter, it is to be regarded as a morbid inorganizable product, and consequently unsusceptible of any change that is not effected by the living tissue in which it is deposited."†

Doctor Todd also in his article on strumous dyspepsia,‡ observes, "that the ordinary termination of the disease is the formation of that morbid growth or deposit well known under the name of *tubercle*, which, most usually seated in the lymphatic glands, has almost exclusively received the name of scrofula." In what manner the strumous state of constitution produces tubercles we are referred to his account of it in Doctor Clarke's work on climate.

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* Encyc. of Medicine, vol. iv. p. 265.

† Clarke, p. 122.

‡ Encyc. vol. ii. p. 155.

This explanation is too long to read; it will suffice here to say that Doctor Todd considers tubercles to be depositions from the arteries, which, instead of secreting healthy, coagulable lymph, capable of becoming an organized tissue, deposit, in consequence of the morbid condition of the system, a matter or lymph "which, from deficient vitality or some other condition, is below the standard of organization, and in this state the nutritive molecules, instead of tissue, may be converted into tubercles."* I have here given sufficient authorities to show the prevailing doctrines of the present time respecting the identity of tubercle and scrofula.

Now, Mr. President, those who theorize ought at least to take good and especial care that all the parts of their hypothesis may harmonize, and that one part may not be in direct contradiction to another. In the quotations I have given from these three influential authorities, the identity of scrofulous tumours near the surface of the body, and tubercles of the lungs and other deep-seated parts, is insisted upon. We also find in every part of their writings on the subject another assumption equally urged, (justly, I allow,) viz.: that inflammation has nothing to do with the production of tubercles, and that when inflammation does occur, it is a consequence, not a cause, of tuberculous deposits.

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* Encyc. p. 655.

How will Doctor Carswell reconcile the two following passages :* at page 267 we read as follows—" under such circumstances it would be absurd to ascribe the origin of tuberculous matter to inflammation." And after arguing the identity of scrofula and tuberculous diseases, we find, at page 259, the following observations :—" inflammation of any organ may be followed by the deposition of tuberculous matter in that organ in the manner in which we have already explained. We have frequent examples of the sub-cutaneous glands of the neck and sub-maxillary glands becoming tuberculous, after an acute attack of inflammation, although previously they were neither enlarged, indurated, nor otherwise diseased."

If an hypothesis be true, it will be found capable of accounting for all the phenomena of a disease. Now here is a stumbling block which I leave to the advocates of the identity of scrofulous and tuberculous diseases to get over; for it must be admitted that scrofulous swelling of the sub-maxillary, cervical, or other glands, is at their commencement, in ninety-nine cases out of a hundred, attended with increase of heat, and more or less tenderness upon pressure on the part, symptoms which obviously indicate inflammation, although in a minor degree to that which occurs in common phlegmon; and yet inflammation, it is admitted, is not necessary for the production of tubercles of the lungs, although it is argued that the two diseases are identical.

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* Encyc. vol. iv.

One proof that there is no identity between scrofula and tubercles is, that the most minute injection cannot be made to penetrate the latter, but no one will be so hardy as to say that a scrofulous gland of the neck or groin cannot be injected; and this fact is in itself sufficient to prove that the two diseases are totally dissimilar, and that there is no identity between them. If tubercles, then, are not preceded or caused by inflammation, as is allowed by those whose doctrines I oppose, I should be glad to inquire what is the cause of those depositions of coagulable lymph of which they are *thus* supposed to be formed. Lymph is not deposited by vessels in their ordinary quiescent state, but by the vessels of parts in which inflammation exists; and although Doctor Todd supposes this lymph to be, from the morbid state of the system, unfit, like healthy lymph, to become organized, it may be asked, why he supposes that lymph, healthy or unhealthy, should be deposited at all, without its usual precursor or concomitant inflammation.

Again, how does this theory explain the formation of those regular, insulated, miliary or granular semi-transparent or opaque tubercles with which we see the surface of the pleura pulmonalis and peritoneum dotted. When coagulable lymph is deposited, it is always in an unshapen, irregular mass, moulded by the form of the parts into which it is poured out. But tubercles, until they spread into each other, in general shew individual shape, form, and regularity.*

It may also be justly urged against this theory, of the inorganic lifeless state of tubercles, that it is contrary to all we know of the nature of animal life, that such masses could remain in living tissues without exciting them to those actions (inflammation and suppuration) calculated to cause their expulsion. Now it is well known that tuberculous masses may remain for years without exciting any action in the parts in which they are imbedded; and so much is this the case, that tubercles in the lungs and other organs are often found after death in those who gave no indications of their presence during life.

It may possibly be urged that extraneous bodies, as for instance leaden bullets, may remain in the body for years without exciting those actions which would cause their expulsion. To this I reply, that all such bodies as are allowed thus to lie quiescent in living tissues are found to be surrounded by a cartilaginous formation, which, it seems, the living tissues in which they are imbedded produce, in order as it were to insulate them from the system. Now, except it were found that tubercles were surrounded by a similar barrier, analogy is strongly against the doctrine that they are insensible lifeless masses.

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* On reading this passage some fine preparations of pulmonary tubercles were shown to the section, which exhibited the appearance of small, *white*, round, compact bodies into which no injection had penetrated, although the surrounding tissues were perfectly red with it.

Although the above considerations induce me to reject the doctrine that tubercles, such as they were first accurately described by Stark, and afterwards by Bayle, Laennec, and many modern pathologists, are identical with glandular scrofulous tumours, yet I do not deny that the scrofulous constitution is the most prone to tuberculous consumption.

I have constantly observed that those persons who suffered from scrofula in infancy and youth, are the most liable in mature and advanced age to cancerous complaints; but surely this circumstance does not prove the identity of scrofula and cancer.

In 1810 I published a small essay, in which I undertook to prove the connexion which existed between indigestion and scrofula; and showed that either the want of powers to assimilate our food, or that aliment unfit to replenish the waste of the body and to supply its wants (the one the most common disease of the rich, the other of the poor) were the most usual causes of scrofula. I considered hereditary weakness, transmitted from debilitated, old, or diseased parents, as a frequent cause of scrofula, particularly amongst the upper classes; and I afterwards considered want of due exercise, cold moist air, improper diet of an ascescent tendency, deficient clothing, and the exanthematous fevers as equally exciting causes of the same disease.

At the time this essay was published, scrofula was universally considered to be a disease arising from an hereditary taint or acrimony in the blood; and the derangement of the digestive organs, with the other causes just enumerated, were totally overlooked as the remote or immediate causes of the disease. The only treatment in use before this publication was sea bathing and a farrago of specifics, thought to be capable of obviating the supposed acrimony or virus to which it was attributed. It is, however, gratifying to me to find that principles, which I was the first to promulgate, are now firmly established; and that, amongst others, even Doctor Clarke has considered the exciting causes of the disease under precisely the same heads which I have given in the small work now on the table before you.

These headings are to be found in his work on Pulmonary Diseases and Scrofula, in the section which treats of the "Causes of Tuberculous Cachexia in Individuals not hereditarily predisposed to Pulmonary Consumption," and are, 1st, improper diet; 2nd, impure air; 3rd, deficient exercise; 4th, imperfect clothing and inattention to cleanliness. Now all these are the precise headings of sections in the work before you, and considered by Doctor Clarke as exciting causes of tuberculous cachexia, or in common language, scrofula. Even he considers the exanthemata as exciting causes of the disease, but not under a distinct heading as I have done. He doubts, however, that syphilis, which in my opinion possesses all the characters of the exanthemata, is an exciting cause. But that the papular venereal eruption, or syphilitic lichen, as it is called, produces obstinate swellings of the lymphatic glands of the neck, I have witnessed in many thousand instances.

It would certainly have been more gratifying to me had Doctor Clarke honoured me by noticing this work; but as it was so small a one probably it escaped his observation, and that his sagacity led him in 1835 to consider this subject, in all its minutiæ under the same views which I happened to entertain in 1810.

Doctor Todd has given an excellent article in the Encyclopædia of Medicine on Strumous Dyspepsia, in which he has *enlarged* upon the precise principles laid down in this same work; and in treating of the deranged functions of the biliary system, he points out, as I had done before him, in what manner all the consequences may follow which produce scrofula. Neither has *he* condescended to notice my priority of claim to these views and principles, which were esteemed, by the orthodox, at the time of the publication of this work, novel and dangerous heresies against long established doctrines.

If tubercles then are not depositions of unhealthy lymph, capable of becoming organized by an extension of the vessels of the tissues in which they are placed, what are they? In one word, it is my opinion that they are beings possessing a vitality independent of the animal in which they are lodged, except so far as that animal affords them; 1st, the organic particles of which they are formed, and 2dly, the nutriment which they imbibe by their own innate powers; and thus, that they form the last link in the chain of the last class of animals, the entozoa. The shock which the mind must receive on first hearing the proposition, that an apparently disorganized mass of animal matter shall enjoy the possession of an independent vitality and state of separate existence, will be considerably lessened by a consideration of the gradual steps by which animal and vegetable life is found to descend, so that at length we have no other mode of distinguishing between dead and living matter, except by a power in the latter of resisting the influence of those external agents, which cause dead animal and vegetable matter to run into fermentable changes.

It was under these views that John Hunter submitted eggs to a freezing temperature destructive of life, and demonstrated by these well-known experiments, that in their ordinary state they have a power of self-preservation, and are not obedient to the same laws which affect dead animal matter; and thus he proved that an egg possesses independent vitality. Hunter goes still farther than I have ventured, in ascribing the principle of life to an apparently disorganized mass of animal matter. He infers that blood possesses life, from its power of coagulation, and adds in illustration of his argument, that if an animal is deprived of life by lightning, or is hunted to death, its blood loses the property of coagulation, and is always found in a state of fluidity.

When we consider the gradual and imperceptible steps in the scale of animal life, and the low degree to which they descend, particularly in the entozoa, or those parasites with which animals are infested, it will not then be found so very startling a proposition to attribute an independent existence to these masses of matter termed tuberculous, which have no connexion by vessels with the parts in which they are imbedded, and yet preserve themselves from those changes to which all dead or inanimate animal matter immediately enters when subjected to moisture and a temperature above the freezing point.

I shall not notice the different species of intestinal worms, but shall call the attention of my hearers to the variety of worms with which the solid tissues of all animals are infested. These have engaged the attention of modern pathologists and naturalists in no slight degree; but we are indebted chiefly to the labours of Brera, Rudolphi, Bremser, Laennec, and Cruveilhier for most interesting information on this subject.

The most simple form of animal matter, as yet acknowledged to be in possession of independent existence, is the hydatid. It is a vesicle filled with a fluid as clear, but of more consistence than water. This vesicle is inclosed in a capsule or cyst, which varies from the consistence of a serous membrane to the firmness of cartilage or even of bone. Bremser justly considers this cyst as the product of the tissue in which the parasite is embedded.

There are only two kinds of hydatids discovered in man: the one most frequently found is termed by Laennec, acephalocystis, because it is simply a vesicle not furnished with either head, mouth, or suckers. By Rudolphi, Bremser, and others it is called echinicoccus. The other furnished with a head, neck, and suckers, by which last it is thought to imbibe its proper nourishment, is a step above the first in the scale of animal life, and is called from its form cysto-circus. It chiefly infests the lower animals of the mammalia class, being comparatively but seldom found in man. However, instances of its presence in human beings are detailed by Werner, Ficher, Treutler, Brera, and Rudolphi.* It was discovered and described by Pallas and Goeze. But the acephalocystis is that form of hydatid which is to be met with most generally in man. In the Leçons Orales of M. Dupuytren, we find a most interesting article on hydatid tumours developed in the muscles and in the viscera. These were chiefly acephalocystis, but he mentions some instances also of the cysto-circus species.

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* Bremser, 286.

The hydatid multiplies its kind by the production of diminutive hydatids within its cavity. By the growth of these the parent hydatid is pressed against the cyst. The cyst increases in size from distention, so that if an hydatid tumour be punctured a multitude of these vesicles will escape. The hydatid, like any other living creature, will of course die a natural death. Those who have watched the progress of dissolution, observe that the first appearance of decline is, that the fluid it contains, from being limpid becomes turbid and opaque, and gradually thickens to the consistence and appearance of softened cheese. The hydatid itself or vesicle becomes wrinkled and contracted, and finally it becomes transformed into a calcareous mass. This final termination of the hydatid is mentioned by John Hunter, Rudolphi, Bremser, Cruveilhier, and all who have treated on the subject. By some the appearance is compared to moistened chalk or putty. The celebrated Ruych* was well acquainted with those transmutations of the hydatid, and makes the shrewd conjecture that those melicerous and atheromatous tumours, such as we meet with every day on the scalp, are nothing more than transformed hydatids; and Cruveilhier was of a similar opinion, viz. that encysted tumours, whether containing serum or melicerous matter are of hydatid growth and origin.

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* Opera Omnia, vol. i. p. 225, Anat. Med. et Chir.

Acephalocyste hydatids are often connected together like bunches of grapes, the stalk of which is attached to part of the human body, and yet in this state they are admitted to be a collection of animals each possessing an independent state of existence. These bunches of hydatids attached to something analogous to a placenta, are often found to be the component parts of false conceptions. They are termed by Wiessmantel, hydrometra hydatica. Bremser* has no doubt that they are distinct animals, though tied together and fixed to the substance of the body; for he justly observes that a great number of aquatic animals are thus attached, of the individual animality of which no person entertains a doubt. Are we to conclude that hydatids (which, though known from the earliest periods, have been only acknowledged in modern times to be distinct animals) form the last link in the chain of animal life, and that there are not still simpler forms also in possession of a separate existence?

Tubercles, I have stated already, have no connexion by means of vessels with the surrounding tissues in which they are imbedded, as is apparent from the preparations before you; they are commonly found in small regular circumscribed masses. They at first, generally before they undergo any transmutation, have the appearance of semi-transparent vesicles; even those that are opaque, on a close examination, I have often found to be hollow; in fact they are thickened vesicles or cysts. But even should they not present the vesicular form, but appear as solid masses without connexion of vessels with the surrounding parts, I do not see why their solidity should be an objection to their possession of an independent vitality. They may continue in this state for months, nay years, without their presence being suspected. As long as they themselves retain life, they do not occasion any stimulus or disturbance in the parts in which they have their nidus, to throw them off; but when they die, they act like extraneous bodies (as we know from the facts respecting the guinea-worm) and occasion local inflammation and general disturbance of the system. They soften afterwards, and if situated in the lungs may be expectorated, and the expectorated matter, as was proved long ago by Stark, is neither pus nor mucus, but is the dead substance of the dead and softened tubercle.

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* Bremser, p. 313.

The present prevailing doctrine concerning tubercles, viz. that they are lifeless masses of unhealthy or vitiated coagulable lymph, incapable of becoming organized, is contrary to the laws which govern animal bodies. No lifeless mass can remain in the tissue of a living body without exciting inflammation and suppuration, by which it may be expelled. Besides, the hypothesis is over strained. Who ever saw coagulable lymph deposited in the form of semi-transparent grey vesicles, or even in these regular compact masses like grains of shot? which we see in the preparations before us, and into which no vessels appear, although all the surrounding tissues are red with injection; and who ever witnessed depositions of lymph first softening and then changing into calcareous masses? But in this, the last transmutation of tubercle, we must be struck with the close resemblance which it bears to the acknowledged animal, hydatid.

Before I proceed farther in my argument, I should wish to call your attention to the following facts, concerning the filea medinensis or guinea worm, of which I have spoken. We know that this worm, which Rudolphi considers peculiar to the body of man, may remain for months, nay, whole years, without producing any sensible uneasiness or accident; that it is only when it approaches the skin, when it pierces it, that pain and other troublesome symptoms are produced. The treatment consists, when the worm thus exposes itself, in seizing the part exposed and rolling it with much caution round a small stick, which is turned very gently every day for fear of breaking the body of the animal; for should this take place the remaining part of the animal would die, and giving, only when dead, the stimulus of an extraneous body, causes inflammation along its entire extent, which is sometimes considerable, the worm having been seen varying in length from one to three feet.

I mention this fact, as throwing much light upon the effects of parasites on man and other animals. As long as the parasite retains the principle of life, it causes comparatively little uneasiness; but as soon as it becomes dead matter, it occasions inflammation in the surrounding parts, the first step to that process by which it is removed from the system. If we apply this fact to tuberculous diseases, it will explain many of their symptoms in a satisfactory manner.

But to return to our argument: let us look to tubercular formations in other parts; they are not caused by inflammation, and how will the doctrine of the deposition of vitiated coagulable lymph account for the presence of those enormous accumulations of regular compact masses of various consistence which are found in the abdomen, to which Doctor Baron has given the name of tuberculated accretions? Medical Journals and Transactions afford an ample supply of these instances. I shall glance at one or two. Doctor Simmins* relates a case which during life was thought to be dropsy, and therefore a fruitless attempt was made by tapping to draw off the water; but after death it was found that the enormous distention of the abdomen was owing to a collection of hydatid tumours of various sizes and consistence.

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* Medical Communications, vol. i.

I have myself given to the public a similar case, which was attended by my friend Doctor Jackson of Dublin, and the late Doctor Joseph Clarke. The swelling of the abdomen was supposed to be pregnancy until the time of parturition had passed. On examination after death we found globular masses, varying from the size of a pea to that of a large orange, each filled with gelatinous fluid or substance which compressed all the viscera. When these masses were removed, the enormous growth may be estimated, when I assure my hearers that nearly a large washin gtub was filled by them. How life could be preserved during the accumulation of such a mass, which seemed only to occasion death by its pressure on the surrounding viscera, surprised us not a little.

Doctor Pulteney relates a case of an extraordinary enlargement of the abdomen owing to a fleshy encysted tomour.*—"It was one of those tuberculated accretions so well known, and weighed, when removed, fifty-six pounds. It was made up," Doctor Pulteney observes, "of a congeries of smaller tumours from the size of a nutmeg to that of an egg, and many were much larger. These were closely compacted and intimately united to each other, each, however, being a separate cell or cyst, with an extremely thick, fleshy coat, containing in its cavity a small quantity of fluid," &c. &c. But enough of this case is detailed to show its nature; that it was a collection of hydatids which had gone through many of their transmutations from the vesicular towards the solid form.*

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* Mem. Medical Society, vol. ii. p. 265.

I shall not take up your time by the detail of cases familiar to every practitioner of experience, and with which all the medical periodicals are amply furnished. Enough has been stated, to evince how insufficient is the doctrine of depositions of unhealthy lymph to account for a class of diseases which are not preceded by inflammation, the general precursor of the deposition of lymph, and if they are at all attended with inflammation, it is either the consequence of the death and softening of those masses, or of their increase to such a degree as to press upon and injure the viscera in their neighbourhood. On the contrary, the doctrine I venture to advocate, that of their possession of independent vitality, and of their faculty of increasing from their inherent powers, satisfactorily accounts for all the symptoms and phenomena which they occasion.

Do acknowledged entozoa arise from the seed or eggs of parent animals of the same description, or are they the product of what is called equivocal or spontaneous generation? I am decidedly of the latter opinion respecting the lowest grade both of animals and vegetables, in which no sexual organs have been discovered. Twenty-five years ago, with the view of explaining the origin of cancer, I advocated this doctrine in my work upon that disease; and since, I find, that it has every day become more and more generally adopted, and among others, by those distinguished naturalists, Bremser, Blainville, and Cruveilhier, who have given the energies of their powerful minds to ascertain the origin, growth, and decline of the entozoa. It is well known to all naturalists, that whenever a slow decomposition of animal or vegetable matter is going forward, assisted by heat and moisture, immediately new forms of organized beings arise; thus the mucor or mouldiness which grows in all damp places, fungi, mushrooms, and lichens take place under similar circumstances. It may be said that the seeds of those vegetable productions are floating in the air; but how account, on the necessity of seminal or oviparous generation, for the green vegetable matter of Priestly? How account for those numerous species of entozoa which are found in the most hidden tissues or organs of the body? How account for the presence of worms in the intestines of an unborn fœtus? But I shall not draw any farther argument from intestinal worms, because many will argue that their eggs are admitted with the food, although it is more rational to suppose that they come from within, and not from without the body, no such worms being ever seen elsewhere, and they can only live for a very short time out of their proper nidus, the intestines. Besides, not only every animal, but each division of its intestinal canal, has its own peculiar species of worm. Thus the lumbricus teres does not reside in the rectum, nor the ascaris in the small intestines.

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* A large collection of hydatids, taken from the abdomen of a fœtus belonging to the Museum of the Infirmary of Bristol, was shown to the section to illustrate this subject.

"Some light," Cruveilhier says,* "may be thrown on the obscure subject of spontaneous generation, from the fact of the production of the infusoria in every liquid in which we macerate a vegetable or animal substance. It at first becomes charged with organic globules, which move in every direction by their own *innate powers, totally independent of the force of gravitation.* These globules are more or less active, and resemble a good deal the globules of the blood, which move with so great a rapidity; desiccation alone arrests the movement of those globules, and humidity again restores it to them. If the maceration is continued, the animals of infusion succeed those organic particles, which, like the spawn of the frog, enjoy great powers of locomotion as well as those of the will, so as to be able to avoid an obstacle, for in their movements they are not observed to strike against each other; in a word, they appear to be gifted with a high degree of vitality." From these facts and views we can no longer admit the axiom of Harvey, "omne vivum ex ovo," but rather in its place substitute that of O'Kerr, "omne vivum e vivo."[*]

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* Dictionnaire, tome vii.

Although "*omne vivum ex ovo*" originated, I believe, with the immortal Harvey, yet his clear-sighted mind could not overlook the fact, that new forms of existence are always arising in humid places where decomposition of course was going forward. In the twenty-seventh section of his work, on the generation of animals, in which he argues that the fœtus, like the chick *in ovo*, draws its nourishment by its own innate powers, he illustrates this fact by the following passage: "What shall we say of those animals produced within our own bodies? No one can doubt but that they grow and are governed by their own independent life (*propria anima*); such as the lumbrici, ascarides pediculi, &c. &c. *For an animal can be produced in almost all dry places which have become moist, or in those humid places which have become dry.*"[†]—In fact, in the situations best adapted for the process of putrefaction or decomposition, without implying the necessity of the agency of eggs or seeds. In another part of the same section he supports the same argument, and as I have lately found to my great surprise, by the admission of the very facts which I am now endeavouring to establish, viz.: the independent vitality of cancer and other fungous parasites. These are his remarks:—" In the same manner the parasitic plants and fungi of trees exist: but even in our own bodies we have cancers, sarcomatous, melicerous, and other malignant tumours, which grow and are nourished as if by their *own innate vegetative life*, (*quasi propriâ animâ vegetativa*,) whilst the parts in which they grow become extenuated and wasted, in consequence of their defrauding the body of its nutritious juices."*

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[*] Dictionnaire, tome vii. 329.

[†] Quid dicimus de animalculis in corpore nostro natis, quæ propria anima gubernari, et vegetari nemo dubitat? Hujus generis sunt lumbrici, ascarides, pediculi, lendes, syrones, acari, &c. &c. Aut quid statuemus de vermiculis, qui è plantis, earumque fructibus oriuntur? Quales in gallis nucibus; cocco baphico, cynorrhodo, plurimisque aliis reperias. *Quippe in omnibus fere vel siccis humiscentibus, vel humidis sicciscentibus, creari animal potest.*—Harvie, *Op. De Generatione Animalium*, Ed. Lugduni, 1737, p. 112.

If worms of the intestines do not arise from seed or eggs, from what cause do they spring? Bremser, who spent twelve years in close application to the disgusting but useful subject of studying the entozoa, advocates the doctrine of their spontaneous generation by facts which cannot be rebutted; and he is of opinion, that worms arise in those who either take in nourishment of an indigestible quality, or who swallow more food than they have powers to digest. In either case materials are furnished for their production in the way we have just considered.

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* Ad hunc pariter modum vivunt fungi arborum, et plantæ supercrescentes. Quin etiam experimur sæpius in corporibus nostris cancros, sarcoses, melicerides, aliosque id genus tumores, *quasi propria anima vegetativa nutriri, et crescere*: dum interea genuinæ partes extenuantur, et marcescunt. Idque ideo, quia tumores isti nutrimentum omne ad se arripiunt, reliquumque corpus nutritio succo (ceu genio suo) defraudant.—*Idem*, p. 113.

Are not hydatids and tuberculous masses formed in the solid tissues of animals, from the precise same causes? Either improper nourishment is taken, incapable of being assimilated, which vitiates the whole mass of fluids, and is unfit to replenish the waste of the system, or else more is admitted than can be assimilated; for we ought to recollect that the last act of assimilation takes place in the lungs, where the blood is submitted to the influence of the air; and this circumstance may tend, in some degree, to explain the greater frequency of tuberculous diseases in the lungs than in any other part of the body.

Dr. Clarke, in his treatise on pulmonary consumption, truly observes, "that what is usually considered the early is in reality an advanced stage of the disease, (tubercular phthisis,) and that tubercle is a secondary affection originating in a peculiar morbid condition of the general system." What is this morbid condition which Doctor Clarke contends for? Is it not a vitiated state, first, of the fluids, and afterwards of the solids, in consequence of imperfect assimilation?

It is many years since I first advocated the doctrine that carcinoma ought to be classed amongst the entozoa, and I am every day more attached to that opinion. There is in every carcinomatous structure two distinct substances. One is a hard cartilaginous mass which admits of being injected, the other is of the consistence of brain, or a medullary substance, which does *not* admit of being injected. The latter I esteem the true entozoa or parasite, the former, *i. e.* the cartilaginous part, I look upon as the barrier which the surrounding tissues throw up to insulate the parasite. This liver of a sheep before you, which contains the animals termed "facciola hepatica," and by the victuallers in Ireland "flukes," will serve to illustrate the subject. Groups of these animals, which, when alive, move with a brisk motion in warm water, are contained, as you see, in cysts of a cartilaginous hardness, or in the biliary ducts themselves. Now the walls of these cysts are capable of receiving injection, as you may perceive by the preparation before you. We must infer, therefore, that those cysts have been formed, not by the parasites, but by the parts in which they are imbedded; and thus a barrier is placed between them and the organs in which they are lodged. When they are produced in a biliary duct there appears to be no necessity for the formation of a cyst; the duct answers the purpose, but the duct becomes enlarged and cartilaginous, as you may see in this preparation. A similar occurrence takes place in the bronchial tubes when tuberculous matter is formed in them. This is finely delineated in Plate I. Fig. 4 of Doctor Carswell's Illustrations of Tubercle. In the one instance we cannot deny the animality of the contents of the duct; but in the other it is inferred from the various facts and arguments contained in this paper. I do not conceive that any argument is afforded against the opinions I advocate on the grounds that tuberculous matter may take the form of the part in which it grows. The same occurrence is observed when vegetable fungi sprout in narrow and confined places, and consequently will take their form and shape from those *external* causes, and yet no one doubts but that they grow by their own internal powers. Now, in order to see the medullary portions of a carcinomatous mass, make a section of it in any direction, and you will perceive, on pressure, the medullary ramification to ooze out at each of its divided branches.

Fungus medullaris or medullary sarcoma, and fungus hæmatodes belong to the same family of disorders, but is chiefly composed of the medullary substance, there being but a very small proportion of the cartilaginous structure. The great distinction between these two last species of the same family is, that in fungus medullaris the medullary mass is contained in a cyst. In the latter there is no distinct cyst, but the medullary mass seems to be subdivided by membranous or semi-cartilaginous bands into separate spheroidal masses; each of these is probably a distinct fungus, the aggregate constituting the diseased structure, or parasitic tumour.

Now, these maladies are much more rapid and destructive than carcinoma, because there is no sufficient barrier thrown up by the neighbouring parts to obstruct their progress. Besides, there is scarcely an instance met with of fungous medullaris or fungus hæmatodes, in which the disorder has been confined to one organ. If we see it in any one part, we may with great certainty infer that it exists in others, and, therefore, conclude that it is owing to some fault in the constitution.

In vol. viii. of the Medico-Chirurgical Transactions, are several interesting cases detailed by Mr. Langstaff, exemplifying the nature and universality of the attacks of fungus medullaris on almost every organ of the body. In the second edition of my work on Cancer, published in 1809, is an account of the symptoms of this same disease in a gentleman* who had those tumours on almost every part of his body. I regret that there was no post mortem examination; but have no doubt but that similar tumours would have been found universally disseminated on the internal organs. Now, although the disposition to carcinoma is also often constitutional or general, yet it is not always so; it is sometimes merely local, and I shall explain under what circumstances it is so.

1st. By a local disposition to cancer I mean that change in a part, from a healthy, sound structure, to a morbid one, which has been occasioned in an otherwise healthy person, either by a direct and immediate violence, or by a continuous application of some irritating cause or agent. For example—the organization of a part may be injured by a severe bruise, and after the lapse of some months, a hardness of a carcinomatous character is found to have arisen in the part injured. Sir Everard Home, in his work upon Cancer, relates two cases, in one of which the disease arose upon the glans penis, in consequence of a violent contusion of that part; and in the other, in the foot from severe pressure and pain occasioned by wearing a tight shoe. In both instances the patients were young and had been previously healthy. In the same manner an ulcer not originally cancerous, such as a venereal bubo in the groin, may, by neglect, bad treatment, or constant irritation, assume, after the lapse of many months, the cancerous character. Or it may happen that frequent irritation of a part, such as the peasantry of Ireland are in the habit of inflicting on their under lips in the act of smoking, from the habit of constantly using short and heated tobacco pipes, may occasion carcinoma in the most healthy, young, and robust persons. Or, as it often happens, the frequent irritation of a pimple or wart, such as occurs in the daily act of shaving, may cause them to assume at length the carcinomatous character.

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* Case XL. p. 197.

2dly. A local disposition to carcinoma may also occur in organs, when they first cease to perform their allotted functions, without any constitutional disposition to the disease. Thus carcinoma chiefly affects the uterus and breasts of women at that period of life in which they cease to be capable of bearing children, *i. e.* from the 40th to the 50th year. These organs may then be considered useless appendages to the system; and a diminution of vitality or some morbid changes, we may infer, take place at this period in their structure, which render them particularly liable to carcinoma. Dionis observes, that out of twenty cases of cancer in women, fifteen will be found to occur between the 40th and 45th years.

But independently of these local dispositions to carcinoma, a strong constitutional disposition exists in others, which is chiefly indicated by a peculiar depressed expression of the countenance, and a pale leaden colour of the skin. In the constitution thus disposed, the disease arises spontaneously and makes rapid progress without shewing any disposition to ulcerate or produce those sloughs of the carcinomatous mass which are analogous to the softening of pulmonary tubercles. It also, in general, assails more organs than one at the same time. The lungs become unsound, and in all subjects of this description, in which I have had the opportunity of making post mortem examinations, these organs were found tuberculated. In such constitutions the experienced practical surgeon never thinks of being able to remove the disease by operation. I trust, however, I have sufficiently pointed out under what circumstances carcinoma may be esteemed merely a local disease, and therefore admitting of operation, or other means pointed out in my work upon Cancer, calculated to cure or alleviate it.

Some modern pathologists have been at great pains to determine the nature of tuberculous formations by the shape and form in which they present themselves; but they might as well attempt to form just conceptions of the nature of those fungi which grow on the decaying surfaces of timber in damp wine vaults, or on the mouldering bark of the more ancient oaks and other forest trees, by a consideration of the shapes they assume, which vary according to the situations in which they happen to arise, as they are moulded and turned from their natural course by every barrier that happens to come into contact with them during their growth. An examination into their internal structure, on which the aid of the microscope may afford much light, is more likely to lead to an accurate knowledge of their true nature.

A consideration of the elementary principles of vegetables, carbon, oxygen, and hydrogen, when compared with those of animals which are the same, with the addition of azot,* should induce us *a priori* to suppose that animal matter, whenever the vital principle is weakened or nearly extinguished, is more prone to fermentable changes, and consequently to the production of parasitic beings than vegetables, which arise in both kingdoms whenever a diminution of vitality loosens the bonds which tie together the component organic particles of which they are composed, and permits them to assume new shapes of existence. It is thus that the simplest forms of organic life are to be met with, as parasitic plants in the vegetable, and the entozoa in the animal kingdom, where every circumstance seems prepared and favourable for their production. The mischievous effects of parasitic plants in the vegetable world has long engaged the attention of the botanist and agriculturalist; and to those of the animal kingdom, which are still more general and destructive, I urgently call the attention of the profession and the public.

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* I do not here notice other primary principles which enter into the composition of living beings, such as sulphur, phosphorus, iron, lime, magnesia, soda, &c. &c.

The analogous disposition to the production of parasites in both vegetables and animals has been long apparent to me, perhaps chiefly in consequence of the vast number of malignant cases, which during a long course of public and private practice have come under my observation. The most remarkable instance amongst them which excited my attention to this analogy was that of an old gentleman, whom I saw many years since, in consultation with Mr. Macklin. There were few parts of his body to be seen that did not betray the growth of cancerous formations. The forehead, nose, prominent parts of his cheeks, lower lip, breasts, testes, &c. &c. exhibited the schirrous, cartilaginous, or horny masses which cancer universally exhibits;

and such was the general prevalence of the disease that I could not avoid remarking to Mr. Macklin, at the time, that this old man strongly reminded me of an ancient oak overspread and exhausted by fungi.

Carcinoma is in general a disease of the middle or advanced periods of life; but in some the predisposition is so strong that it may occur even before the age of puberty. Some years ago I examined, in conjunction with Mr. Peile, the body of a young woman twenty-one years of age, who died of cancer of the womb; and I lately had an opportunity of observing extensive carcinomatous accretions in a girl of fourteen, whom I attended for nearly a year on account of a variety of complaints which evinced disease of nearly all the viscera of the different cavities. In making a post mortem examination, in which I was assisted by my friend and former pupil, Mr. Belton, we found tubercles or carcinomatous tumours in all the cavities. In the anterior lobes of the brain there were encysted fungous tumours about the size of wallnuts. There was a large mass of a semi-cartilaginous substance in the anterior mediastinum. The lungs were tuberculated. Both mammæ were enlarged, and presented the usual cartilaginous appearance of carcinoma, and the mesenteric glands were also in a tuberculated state.

I might adduce numerous other instances of carcinoma occurring at an early period of life, but the above are sufficient examples. In these two persons, who thus died its early victims, the countenance had the remarkably pale hue, with a tendency to lividness, called a leaden colour, to which I have before alluded.

It is to be remarked that Andral has made very similar observations respecting the colour of the skin in those predisposed to tubercular phthisis; he says, "observation has proved, that it (tubercle) has an especial tendency to grow in those individuals whose skin is very fair, and as it were *blanched and without any trace of colouring matter* in its capillaries. The colouring matter thus deficient in their skin is likewise so in their eyes, which retain the blue tint of infancy, and in their hair, which is light coloured, and also small in quantity. Their muscles are soft and slender, and shew little contractile power; their blood is serous, and deficient in fibrine and *colouring matter*."*

In chapter viii. of the 2nd edition of my work upon Cancer, published in 1809, I have particularly noticed this peculiar character and colour of the countenance of those disposed to carcinoma and tubercular phthisis, and ascribed it to want of colouring matter in the blood. I have also in the same chapter related some post mortem examinations of those who died of external cancer, having at the same time tubercles in the lungs, and that on comparing the structure of one with the other (the cancerous mass with the tubercles) little or no perceptible difference was apparent. These facts, coupled with the various circumstances and analogical reasonings stated in this paper, afford, to say the least, a strong presumption, that pulmonary tubercles are more nearly allied to carcinoma than to scrofula.

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* Townsend and West's Andral, vol. ii. p. 535.

One remarkable circumstance attending the transmutations of pulmonary tubercle and hydatids is, that in the last change of both one and the other the same identical appearances are presented. Thus in both we find a matter of a cheesy or putty-like appearance, with calcareous matter. I have already given sufficient proof that such is the last transmutation of hydatids; now I shall adduce one or two esteemed authorities, that tubercles in the lungs and elsewhere have a similar termination.

Carswell, speaking of the last transmutation of tubercles, at that period at which he infers that the disease had undergone a natural cure, says, "the tuberculous matter, whether contained in a bronchial tube, the air cells, or cellular tissue of the lungs, assumes a dry *putty-looking*, *chalky*, or *cretaceous* character;" and he has beautifully illustrated this fact in Plate IV. Fig 4, of his Pathological Anatomy.

Monsieur Regnaud, in his accurate memoir on the Obliteration of the Bronchi, inserted in the Memoirs of the Royal Academy of Medicine, enumerates tubercles as one of the most influential causes. "In phthisical patients," he remarks, "it is not uncommon to meet in different points of the lung, particularly near the top of it, encysted or free masses, resembling tubercle, soft plaister, or dry chalk, varying from the bulk of a pea to that of a walnut. These chalky masses, or those resembling dried tubercles, are contained in pouches more or less thick. The contents of these pouches are different: sometimes they are like tuberculous matter, oftentimes it is like wet plaister, at other times so dry as to crumble between the fingers; again it is found like chalk, resisting the edge of the scalpel, and it is not unusual to find small portions of a matter as hard as silex in their centre."

Andral observes, "we sometimes find tubercle acquires an unusual hardness and becomes transformed into a gritty mass, in which chemical analysis shows a notable quantity of phosphate and carbonate of lime; these salts are also found, but in much less quantity in ordinary tubercles, so that their cretaceous transformation is merely a withdrawing, a re-absorption of the animal matter." He then gives the analysis, by Thenard, of tubercles in their natural state, before they had undergone any softening transmutation. He adds their analysis after they had undergone their last or cretaceous change. In both states it appears that carbonate and phosphate of lime enter largely into their composition. We may then infer that when hydatids and tubercles, like the animal which they infest, die, and undergo their last transmutation, their soft parts disappear, leaving only the earthy particles behind, which bid defiance to the process of putrefactive fermentation or absorption to remove. Now, as it does not appear from any known analysis that coagulable lymph contains phosphate and carbonate of lime, the inference is obvious that the prevailing theory respecting tubercles is wrong; and on the contrary, as we find cretaceous matter containing both phosphate and carbonate of lime is always found in hydatids, the lowest order of entozoa at present acknowledged, a strong additional inference is afforded, that tubercle constitutes another and the last link of this class.

In the presence of those earths, even in the lowest animals, we cannot help observing something of that type upon which the Creator formed the entire animal kingdom. For as the nervous system is not, in zoophytes, or the lowerst grade of animals, collected into distinct cords, but is universally diffused through their substance, so we find those earthly particles which form the basis of the skeleton of higher classes, diffused also through the system of these, the last link in the chain of animal life.

At the last meeting of the Association, my friend Doctor Houston read an interesting account of cysto-circi hydatids, found in the abdomen of an Axis deer. Bunches of soft tumours, varying from the size of a pea to that of an orange, were attached to the omentum and peritoneal folds of the different viscera. These were found to be the capsules of those hydatids. Now, although this animal's lungs were found to be filled with tubercles of which he died, yet Doctor Houston cannot see that there was any connexion between the one morbid appearance and the other. To my simple apprehension there appears to be a very close connexion, indicating a disposition in the creature to the production of parasitical animals, which in the abdomen appeared in the form of hydatids, and in the lungs in that of tubercles, an opinion which is supported by a fact mentioned incidentally by Andral, who found, in conjunction with M. Dupuy, tubercles intermixed with hydatids of cysto-circus species in the lungs, heart, and muscles of a hog.*

I have been informed from undoubted authority, that hydatids and tubercles have been very generally found in the bodies of dairy cows in Paris; and in fact we have sufficient data to conclude that tubercles and hydatids are produced in the tissues of all animals confined in menageries, or which, deprived of their natural exercise, are exposed to an unwholesome and vitiated atmosphere.

I have for some time been anxious to ascertain if tuberculous matter, before ramollissement commences, possessed a power of preserving its life at the temperature of the body from which it has been taken, and of resisting those fermentable changes to which all dead animal matter is subject. I was also desirous of trying an analogous experiment to that of Hunter, by which he ascertained that an egg is in possession of life. But since these ideas suggested themselves to my mind, I have not been able to procure any undecomposed tuberculous substance, fresh and sufficiently insulated from that of the animal matter in which it was imbedded, to admit of experiment.

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* West and Townsend's Andral, vol. i. p. 533.

The prevailing doctrine respecting tuberculous diseases has derived its chief support from Doctor Carswell's indefatigable labours in the field of pathological anatomy; and although I dissent from his views, there is not amongst his friends an individual who feels more disposed to give him the credit he so amply merits for his accurate descriptions and most satisfactory illustrations of tuberculous diseases. It is with reluctance, therefore, that I differ so materially in opinion from one who has done so much to advance the science of medicine: *that* reluctance is, however, in some degree diminished by the recollection that the doctrine I espouse has been supported by pathologists of the highest eminence; amongst others, Laennec, as we must infer from the following passage: his words are, "tubercles are accidental productions, that is *real foreign bodies which spring up* in the substance of the lungs, and may be developed in any other texture of the body." His translator and commentator, Doctor Forbes, incidentally acknowledges in a note that Laennec believed in the independent vitality of tubercle, and observes, "that Laennec's views were called in question by Majendie, Cruveilhier, Andral, Lombard, and Boullard, whose researches, he says, "all tend to establish the proposition that tubercle, instead of being an accidental production, possessing a proper vitality, and developing itself by *intus-susception*, like organized tissues, is in fact the result of a morbid secretion, a peculiar species of pus, an inorganic product formed by juxta-position." I trust, however, that I have adduced some strong facts and considerations respecting the parenchymatous substance of which tubercle is composed, and the laws of the animal economy, to evince that the views of this celebrated philosopher and physician were not erroneous.

The experiments of Doctors Jenner and Baron strongly support the doctrine of the parasitic nature of tubercle. These pathologists seem, however, to be of opinion, that independent life can only be attached, in the instances under consideration, to a substance which at first has the vesicular or hydatid form. In this I differ from them, as I have already sufficiently stated my reasons for concluding that tubercles composed of a medullary parenchyma may also be endowed with individual life; and thus I extend the possession of a proper vitality to an animal mass even apparently less organized than the acephalocyste hydatid.*

Doctor Farre, in his work upon Organic Diseases of the Liver, states his opinion also, that a fungous or medullary form of tubercle of that viscus was in possession of a proper vitality, and developed itself by its own innate powers. Doctor Adams, the author of the work on Morbid Poisons, long since advocated the same principle respecting carcinoma, but ascribed it to the hydatid form of existence. But as it is only *occasionally* that we observe in cancer any thing approaching the hydatid form, it is probable on this account that his opinions did not meet with that attention from medical men to which they had undoubted claims. The first edition of my work on Cancer was published in 1806, in which I avowed, without hesitation, my belief in his doctrine, differing from him, however, in this respect, that he placed the vitality in the hydatid structure, whereas, I supposed it to exist in the cartilaginous substance. In this I was manifestly wrong, as the cartilaginous portion is capable of being injected, a fact not then ascertained. But to the medullary portion I now attribute individual life, not only because it cannot be injected, but because it resembles in structure medullary sarcoma and tuberculous formations in other parts. In the same work, as already mentioned, I afforded some striking facts to induce us to suppose that carcinoma and pulmonary tubercles belong to the same family of diseases; and I understand that the doctrine of the independent vitality of tuberculous diseases is making considerable progress amongst the physicians of Germany.

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* Andral, who is opposed to the opinions of those who advocate the independent vitality of tubercle, admits that "there are some entozoa that consist of nothing but a parenchymatous mass, without any distinct cavity or perceptible organ."—TOWNSEND and WEST'S *Andral*, vol. ii. p. 616.

From the authority of those writers who have favoured, and even espoused the doctrine of the independent vitality of apparently disorganized masses of animal matter, amongst whom are men remarkable for high intellectual powers and deep medical research, you have *a priori* testimony that the doctrine, or if you prefer to call it so, the hypothesis, ought not to be esteemed beneath the attention of this Association; and I flatter myself that I have made out a strong case in its favour, and added some important facts and views towards its support, which will, I trust, awaken your attention to a class of diseases that, under the old established doctrines, have justly been considered as the *opprobrium medicorum.*

If my views of these diseases are correct, and founded in nature, another, but a lower link will be added to the entozoa, which, according to Cuvier, belongs to the second class of zoophytes. The following species may at present be enumerated:—

1st. Tubercle of the lungs and other parts, whether commencing in the form of a grey semi-transparent vesicle, or of a whitish medullary substance.

2ndly. Masses of tuberculous matter in the abdomen, which either commence in the hydatid form or in that of medullary tubercle. These are called, by Doctor Baron, tuberculated accretions.

3rdly. Fungus medullaris and fungus hæmatodes.

4thly. Carcinoma.

Under these views, it is therefore obvious that the business of our profession is rather to point out the means by which these diseases may be prevented, than in endeavouring by vain efforts to cure them. This observation, however, demands a slight qualification. When a tuberculous disease is merely local or inconsiderable, it may admit of a cure, and the remedial measures upon which I would place most reliance, in addition to the improvement of the general habit by due attention to diet, air, and exercise, are the gradual introduction into the system of iron and iodine. The first, because it furnishes to the blood not only an ingredient necessary to red-blooded animals, but is a powerful antidote against the inroads of entozoa of every description; and the second, because it is the most powerful agent with which we are acquainted in promoting the absorption of all morbid productions. But when tuberculous formations are general and constitutional, it is irrational to expect that any human measures can prevent the fatal result. What then are the most likely means of protecting mankind from the attacks of those dreadful maladies? The answer is simple and easy. All that is required is *wholesome nourishment, pure air, temperance, and exercise.*

Amongst the lower order of society, those employed in sedentary occupations in crowded manufacturing towns, are by many degrees more prone to them than those who, living by agriculture, labour in the open air, and are not obliged to breathe the impure atmosphere of crowded cities. The former, besides, being prevented by sedentary occupations from taking that wholesome degree of exercise in the open air necessary for the due enjoyment of health, constantly commit great errors in diet, and to these combined causes we may justly attribute their greater liability to tuberculous diseases than their more fortunate fellows whose occupations are in the open country.

"The comparative exemption of those who follow agricultural pursuits is, no doubt, owing to their simple and restricted diet, coupled with habits of laborious or active exercise, which occasions a rapid expenditure of the materials of the body, and an immediate demand for more, owing to the acuteness of the sensation of hunger. The high state of activity of their digestive organs at the same time enables them to supply a healthy chyme to replace the exhausted materials, provided that their nourishment be wholesome. The consequence is, that the entire frame is in the most healthy state, every organ performs with energy its allotted function, for every portion of the body is endued with its due portion of vitality. No accumulation of half animalyzed particles is found in the system fitted to afford a nidus for the growth of parasitic fungi, such as we may presume to occur in the bodies of the indolent, the voluptuous, and the intemperate, who gorge their stomachs to excess with a variety of the most nutritious diet, without possessing the powers to digest it."*

But multitudes, it will be urged, come into the world with the very seeds of tuberculous disease so deeply sown in their constitutions, that without any fault of their own, those maladies make their appearance immediately after birth, and even in many instances before it. This is true ; but it is equally true, that this apparent injustice of Providence is manifestly the natural and inevitable punishment of a breach of the organic and moral laws committed by their parents ; who, in despite of disease, of feebleness, of the exhaustion attendant upon old age, and of the deterioration of progeny consequent upon close relationship, without compunction marry, and produce a puny, wretched, and diseased offspring, whose organs are incapable of performing their allotted functions.

The punishment inflicted thus upon the children, and reflected back again upon the parents in anxiety and sorrow, explains and justifies that apparently harsh, but natural and necessary law, that "the sins of the parents are visited upon the children, even to the third and fourth generation." THEN, fortunately, perhaps, a degenerated race may cease to possess the power of propagating its kind.

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* See my Introductory Lecture for 1827.

POSTSCRIPT.

On reading the foregoing paper, which, although it occupied one hour and a half, was listened to with the most flattering attention, the President, Doctor Roget, gave his opinion, that notwithstanding other papers were nominated for a hearing on that day, yet as the subject of the one just read opened a very wide field for discussion, the remainder of the day would be more advantageously occupied in its consideration. Upon which, Doctor Macartney, Professor of Anatomy of Trinity College, Dublin, made, as well as I can recollect, the following objections.

1st. That the vesicular or hydatid-like appearance of tubercles is owing to the circumstance, that they are penetrated by the air cells or bronchial tubes of the lungs, and, therefore, cannot be considered hydatids.

2ndly. That tubercles can be injected, and that he himself had succeeded in injecting them.

3rdly. That the substance of tubercles could be taken up by the absorbents; from which it is obvious that they are not living bodies, for the absorbents of one animal have not the power of absorbing any portion of the living substance of another.

4thly. That the offensiveness of the breath of a consumptive patient militated against the principle I advocated respecting the nature of tubercles.

5thly. That hemorrhage from the lungs in tubercular phthisis, when it arises from a vomica or tuberculous excavation, is owing to an inflammatory state of the vessels of the lungs, a circumstance not likely to take place on the principle I advocated.

To the first objection, I replied, that tubercles frequently arose on the pleura pulmonalis, or even on the peritoneum in the cavity of the abdomen, and that in either instance it was obvious that the vesicular appearance of tubercle to which Dr. M. alluded, could not possibly be owing to its being permeated by a bronchial tube or air cell. I added, that I did not conceive that tubercles must necessarily exhibit the hydatid or vesicular form at their commencement; on the contrary, I had expressly stated in my paper, that they as often commenced in the form of compact, solid, round, white medullary bodies.

To the second objection, I replied, that if Dr. Macartney had succeeded in injecting tubercles, he had accomplished that which no other person had been able to perform. That our countryman, Stark, was the first to announce that tubercles could not be injected, in which assertion he had been subsequently supported by the united testimony of every pathologist, foreign and domestic, who had treated on the subject. In support of this assertion I pointed to the several fine preparations of tuberculated lungs which lay on the table; in which were displayed compact, rounded, *white* tubercles, into which not a particle of injection had penetrated, while the parenchymatous substance of the lungs surrounding them was rendered perfectly vermilion with injection.

To the third objection, I replied, that the substance of tubercle, while endued with the principle of life, did not admit of being absorbed; but that when it lost this principle and became decomposed and softened, it was then liable to absorption. That the absorbents were not, however, capable of taking up the earthy particles, carbonate and phosphate of lime, which entered into the composition of tubercle, that consequently these particles remained behind, and blending with some moist animal matter assumed the consistence and appearance of putty, or chalk and water, contained in a shrivelled cartilaginous cyst, which is the last transmutation (resembling that of hydatids) of such tubercles as do not open into a bronchial tube. The cartilaginous cyst, as I observed in my paper, being the barrier which the surrounding tissues throw up to insulate and check the progress of the increasing entozoa.

To the fourth objection, I replied, that when the tuberculous substance, in a softened and decomposed state, is exposed to the air, in consequence of ulceration of one or more of the bronchial tubes in its neighbourhood, of course it undergoes the same fermentable changes to which all dead animal matter is subject when exposed to air, heat, and moisture; and consequently that the breath becomes, as it often does in phthisis, intolerably offensive.

To the fifth objection, I replied, that there is no necessity to infer, that hemorrhage from the lungs must be occasioned by inflammation of these organs, when it does not take place from tuberculous excavations; because hemorrhage may be occasioned by the increase and growth of tubercles to so great an extent as to compress the vessels of the lungs, and impede the circulation through them, and from this cause is satisfactorily explained the frequent occurrence of hemoptysis in cases of tubercular phthisis, where no excavations have been found on a post mortem examination.

Doctor O'Beirne inquired of Dr. Macartney, whether he had ever found cellular membrane in tuberculous matter, because it was generally acknowledged, that, whenever blood-vessels ramified, cellular membrane existed to connect them with the surrounding tissues. To this question Doctor Macartney replied, that he *had* found cellular membrane in tuberculous matter. On which Doctor O'Beirne observed, that Doctor Macartney's experience was contrary to that of Doctor O'Beirne, and he believed of all other pathologists.

The only other objection that was urged against the parasitical nature of tubercles was by Doctor Houston; who said, that as I alluded to the post mortem appearances of an axis deer, which he had communicated to the Association at a former meeting, he was induced to state his dissent from my conclusion, that because the animal had hydatids in its abdomen and tubercles in its lungs, I had reason to infer that the latter, like the former, were parasitic beings; that he, on the contrary, considered the tubercles, in this animal, to be the consequence of inflammation. To this observation I merely replied, that I placed more reliance on his facts than on his opinions, and that I would leave others to judge whether his or mine on this point (as detailed in p. 44) were most to be relied upon.

Doctor Symonds then objected to the manner in which the views of Doctor Carswell, Clarke, and others had been stated, respecting the identity of scrofula and tuberculous disease, and denied that they supported this identity.

To this objection, I merely replied by referring to the passages from their respective works, as quoted in pp. 9 and 10 of this paper, which prove decidedly that I had not dealt unfairly with them, or misrepresented their opinions.

THE END.